

# Short-Term Technical Training Activities of the Sanitary Engineering Center

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**T**ECHNOLOGICAL developments resulting from scientific research bring many benefits, but often they introduce new and complex problems in environmental health. Increased food production has meant concomitant widespread exposure of the populace to toxic pesticides. Increased automobile transportation has resulted in smog gradually becoming indigenous to every urban community. The surging growth of the chemical industry has been accompanied by a concurrent degradation of water quality. Nuclear energy has brought its associated radiation hazard. Fortunately, research on ways to deal with these problems is expanding, too. Our concern is that the resultant new knowledge be put into effective practice with the shortest possible timelag. In-service or intensive short-term training is a most efficacious means to this end, but its use must greatly expand to keep pace with the developments in knowledge.

A new program at the Massachusetts Institute of Technology emphasizes what has long been the goal of Public Health Service training in environmental sciences and engineering: to fill the gaps in knowledge, skills, and motivation of public health workers, thereby reducing the lag between scientific advances and their application in the field. In a move to update

the knowledge and skill of key practicing engineers, the Sloan Foundation granted M.I.T. \$5 million in 1963 to conduct 1- to 10-week courses for graduate engineers to "increase their competence by intensive education in modern concepts and discoveries of science. . . . The rapid rate at which new data and techniques are developing is forcing working scientists and engineers to pursue additional, more personal study so they can translate the new developments into practical and worthwhile uses—and at the same time, to avoid professional obsolescence" (1).

In the same vein, at the dedication of a new research complex for the Communicable Disease Center, Public Health Service, on Sept. 8, 1960, Congressman John E. Fogarty of Rhode Island said, "As we dedicate this great center for applied research, let us also dedicate ourselves to seeing that the knowledge gained here is indeed applied. Let the ingeniousness in adapting old ways, finding new ways, challenging tradition if necessary, assure that, when knowledge leaves the laboratory, it reaches promptly all the people, rich and poor, young and old, whose health it can protect."

## Application of Research Data

In striving to apply new research findings in environmental health, special conditions must be recognized. The need to protect ourselves exists while awaiting the answers from research; yet, as Congressman Fogarty pointed out in a recent address to an environmental health group: "It would be shortsighted and irresponsible to take no action while we await

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the final results of research. Common sense leads us to fear certain contaminants before the precise nature and extent of the dangers have been proved" (2). Overlapping and interrelating causes and effects and the need to protect ourselves from environmental hazard, even while awaiting better answers through the research process, compound the problem of providing adequate, up-to-date short-term training for the professionals in the field. The official in air pollution control, for example, must also have knowledge and skill in the determination and measurement of airborne radioactivity. The food and dairy specialist must be able to establish the presence of pesticides and radionuclides and interpret their significance. No one would consider curtailing medical and industrial uses of radioactive products, yet their increasing use calls for an army of trained technicians competent not only to serve the immediate beneficiaries but to protect them and the total population.

#### Courses of the PHS Center

The largest segment of the short-term courses of the Environmental Sciences and Engineering Program of the Robert A. Taft Sanitary Engineering Center, Public Health Service, Cincinnati, is designed for the practicing professional—the engineer, chemist, biologist, physicist, and sanitarian; for environmental health workers from State and local agencies and industry and for members of university faculties. A second segment is designed for technical administrators and for officials of State and local health departments, other public agencies, and industry whose responsibilities demand a broad but sound technical awareness of the environmental health problems that arise in their areas of supervision. This segment includes such courses as Elements of Air Quality Management, Management of Nuclear Emergencies, Water Quality Management, and Airlines Sanitary Food Service. A third segment is the most significant in many ways, because environmental health goals can no longer be accomplished by efforts of professional workers alone. This segment consists of courses directed to the vast lay population—industrialists, government officials, politicians, and mem-

bers of civic organizations and other organized community groups who influence the general population. Examples of such courses are Orientation in Air Pollution, Orientation in Occupational Health, Current Problems in Water Quality Management, and Urban Planning for Environmental Health. The courses are described in the annual Bulletin of Courses of the Environmental Sciences and Engineering Program (3).

The Public Health Service effort in short-term training in environmental health for fiscal year 1963 is highlighted in tables 1 and 2. Professional backgrounds of the 2,299 technical course trainees were as follows:

<i>Profession</i>	<i>Number</i>
Administrators.....	103
Biologists and microbiologists.....	124
Chemists and physicists.....	372
Dentists.....	34
Engineers.....	885
Health educators.....	11
Industrial hygienists.....	94
Nurses.....	57
Pharmacists.....	15
Physicians.....	58
Sanitarians.....	192
Technicians.....	132
Veterinarians.....	20
Others.....	202

Of the 1,937 technical course trainees known to have degrees, 1,173 were at the bachelor level, 620 at the master level, and 144 at the doctorate level; the degree status of 362 was unknown.

The engineering center's intensive, short-term training is planned, developed, and conducted by a full-time staff of specialists composed of scientists, engineers, and physicians in the fields

**Table 1. Technical and orientation courses in environmental health, Public Health Service, fiscal year 1963**

Courses	Number of trainees	Weeks of training
Radiological health.....	1,124	77.0
Air pollution.....	658	21.9
Metropolitan planning.....	638	7.0
Water supply and pollution control.....	491	23.4
Food protection.....	322	8.8
Special.....	170	12.2
Total.....	3,403	150.3

**Table 2. Employing organization of technical course trainees in environmental health, Public Health Service, fiscal year 1963**

Organization	Number of trainees with—	
	Health-related employer	Non-health-related employer
Government:		
State.....	442	120
Local.....	195	99
Public Health Service.....	682	---
Department of Defense.....	---	214
Other Federal.....	44	88
Universities:		
Student.....	22	---
Faculty.....	83	---
Industry.....	---	180
Consulting firms.....	---	29
Others.....	0	101
<b>Total.....</b>	<b>1,468</b>	<b>831</b>

of our concern, that is, air pollution, water supply and pollution control, radiological health, occupational health, food protection, and metropolitan planning. Each staff member is trained not only in his specific discipline but also in the techniques of teaching. Both types of training are continuous. We seek to maintain a program flexible enough in scope and depth to accommodate new knowledge as it develops and a staff of teachers not only able and creative in their respective disciplines but also able to develop new training techniques. Special courses and seminars in new training techniques are conducted at the center and at other locations.

The full-time staff is supplemented by a supportive staff from the center's research laboratories and by consultants from universities and private industry. For fiscal year 1963, the guest experts on our faculty numbered 370 and represented an important segment of the knowledge and expertise in the environmental health field. The combined staff gave substantial evidence of the important partnership that the government has welded with industry and universities to meet the pressing need for professional competence.

Basic to environmental sciences and engineering training are the goals of active trainee participation in courses and use of all effective teaching techniques. While the classic lecture

is still used, it is used in such a way as to permit the trainee to participate with the lecturer, not only during the presentation but also in subsequent discussions. Laboratory sessions, which take approximately 50 percent of course time, provide opportunities for development of trainees' skills. Problem sessions offer occasions for evaluation of data, report writing, design of control equipment, and development of pilot health programs. Field exercises provide experience in the practical application of sampling and survey techniques. The traditional textbook is supplanted by a specially designed course manual to give more direct and positive support to the teaching effort. The manual, prepared by our staff for the specific course, presents the subject matter in a structured format, which greatly assists the learning process. To give some concept of the magnitude of this effort, the Bulletin of Courses, fiscal year 1965, lists 69 different courses, and all required up-to-date manuals. A variety of visual aids created and executed by a staff of specialists in visual communication supplement instruction.

### New Teaching Techniques

Programed instruction was recently added to the center's training activities in order to obtain more precise definition of training objectives and to improve the performance following training. Such instruction is gradually being widely applied in the public health field with evident effectiveness. To acquaint our staff with the philosophy and techniques of programed instruction, experts in this field from government, universities, and private enterprise came to the engineering center for a seminar in January 1963 (4). A manual by Robert F. Mager, a seminar consultant, offers an incisive view of the need for clearly stated objectives in short-term training of this type (5). A brief explanation of the meaning and significance of this teaching technique and of its potential applications and advantages in the field of water quality appeared recently (6).

We introduced closed-circuit television in the fall of 1963. Television permits classroom presentation of demonstrations performed in the microscope room, the counting rooms and, even more important, in the research laboratories.

It permits clear, unobstructed viewing by all trainees, a benefit not possible when trainees must group themselves around a table, a counter, or a piece of equipment. Recently, in a classroom, we used television to show a laboratory demonstration of the gamma spectrometer. This instrument is too large to be moved and is housed in a space too small to accommodate even a small class. One camera focused on the instructor as he identified and explained the components of the analyzer system—the shield, detector, multichannel analyzer, and data read-out devices. A second camera was focused on the oscilloscope to show the changes in data as the instructor calibrated and operated the analyzer. Two-way communication between the instructor and the trainees permitted the trainees to interrupt the demonstration at any point to ask questions.

To provide continuing inservice training for those for whom travel distance makes participation in courses at the engineering center impossible, training institutes are conducted at selected sites throughout the country—in effect moving the center to various regional sites. A particular advantage of the training institute lies in the scope and variety of courses offered in the environmental areas of local concern. In this dispersed training, we depend heavily on the cooperative assistance of the staffs of Public Health Service Regional Offices and of the faculties of the participating universities. The Environmental Sciences and Engineering Training Program, in collaboration with the School of Engineering and Architecture of the City College, City University of New York, conducted an institute of six concurrent courses in April 1964. A west coast training institute of 12 courses was conducted simultaneously during July and August 1964 at the University of Washington at Seattle, the Oregon State University at Corvallis, the University of California at Los Angeles and Davis, and at Los Vegas and Honolulu. On request, special arrangements for course presentations are made in cooperation with individual States. The availability of grant support through the Community Health Program of the Public Health Service can greatly assist States in meeting needs for localized training. This support provides per

diem expenses for trainees and faculty stipends but no travel costs.

To fulfill, at least in some measure, the need for motivated and trained personnel of the future, the training program cooperates with the secondary schools of Greater Cincinnati in a number of activities, including organization of special days with formal programs for both science teachers and selected science students. Experiments designed by science teachers in collaboration with engineering center personnel have been widely used throughout the country. Another cooperative venture with local science teachers is planned to develop television presentations of experiments dealing with environmental health.

The highly specialized, intensive, short-time training course meets the needs for professional growth in the environmental health field through continuing, inservice training. While it is traditional to speak of learning in the professions as a lifetime process, a new urgency requires more positive action to make this ideal the general practice. Career development is not restricted to the professional neophyte; it applies to all. Recognizing this, public and private agencies might well plan at least 1 week of intensive, specialized training for each worker annually.

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